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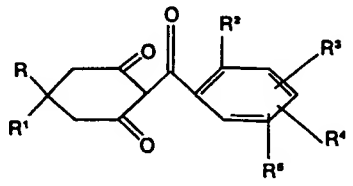
(54) Certain 2-(2-substituted Benzoyl)-1,3-Cyclohexanediones.

(57) Compounds having the structural formula



wherein R and R¹ are hydrogen, C_1–C_4 alkyl, $R^aOC(O)$–, where R^a is C_1–C_4 alkyl; R^2 is chlorine, bromine, iodine or C_1–C_4 alkoxy; and R^3, R^4 and R^5 independently are hydrogen or an aliphatic group.

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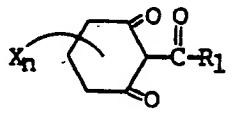
CERTAIN 2-(2-SUBSTITUTED BENZOYL)-1,3-CYCLOHEXANEDIONES

Cross-Reference to Related Applications

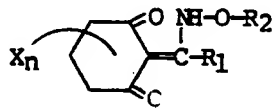
This application is a continuation-in-part application of Serial No. 587,331, filed March 7, 1984; which in turn is a continuation-in-part of application Serial No. 532,869, filed September 16, 1983; which in turn is a continuation-inpart application of 464,251, filed February 9, 1983, now abandoned; which in turn is a continuation-in-part application of Serial No. 361,658, filed March 25, 1982, now abandoned.

Background of the Invention

Compounds having the structural formula



wherein X can be an alkyl, n can be 0, 1, or 2, and R_1 can be phenyl or substituted phenyl are described in Japanese Patent Application 84632-1974 as being intermediates for the preparation of herbicidal compounds of the formula



wherein R_1, X, and n are as defined above and R_2 is alkyl, alkenyl, or alkynyl. Specifically taught herbicidal compounds of this latter group are those where n is 2, X is 5,5-dimethyl, R_2 is allyl and R_1 is phenyl, 4-chlorophenyl or 4-methoxyphenyl.

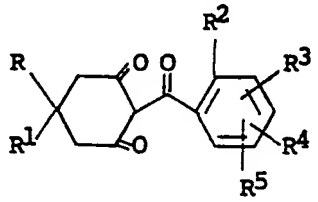
The precursor intermediates for these three specifically taught compounds have no or almost no herbicidal activity.

In contrast, the compounds of this invention have exceptional herbicidal activity. Applicant's compounds must have a chlorine, bromine, iodine or alkoxy substitution in the 2-position of the phenyl moiety of their compounds to obtain the exceptional herbicidal activity. Chlorine is the preferred substituent. The exact reason why such a substitution

imparts exceptional herbicidal activity to the compound is not fully understood.

Description of the Invention

This invention relates to certain novel 2-(2-substituted benzoyl)-cyclohexane-1,3-diones as herbicides. The compounds of this invention have the following structural formula



wherein

R and R^1 are hydrogen, C_1-C_4 alkyl, preferably methyl or isopropyl, $R^aOC(C)$-, where R^a is C_1-C_4 alkyl; most preferably R and R^1 are hydrogen;

R^2 is chlorine, bromine, iodine or C_1-C_4 alkoxy, preferably methoxy; most preferably R_2 is chlorine, bromine or methoxy;

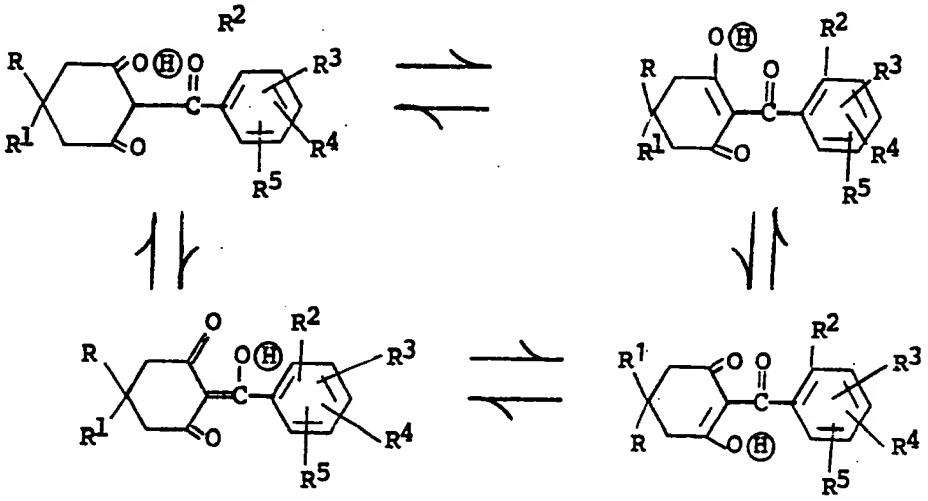
R^3, R^4 and R^5 independently are hydrogen or an aliphatic group, preferably: (1) hydrogen; (2) halogen, preferably chlorine or bromine; (3) C_1-C_4 alkyl, preferably methyl; (4) C_1-C_4 alkoxy, preferably methoxy; (5) OCF_3; (6) cyano; (7) nitro; (8) C_1-C_4 haloalkyl, more preferably trifluoromethyl; (9) R^bSO_n- wherein R^b is C_1-C_4 alkyl, preferably methyl, C_1-C_4 haloalkyl, phenyl, benzyl, $-NR^dR^e$ wherein R^d and R^e independently are hydrogen or C_1-C_4 alkyl; and n is the integer 0, 1 or 2, preferably 2;

(10) R^cCNH- (with O)

wherein R^c is C_1-C_4 alkyl, (11) $R^fC(O)$ wherein R^f is hydrogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy; (12) $-NR^gR^h$ wherein R^g and R^h independently are hydrogen or C_1-C_4 alkyl; or less preferably (13) R^3 and R^4 together can form a ring structure with two adjacent carbon atoms of the phenyl ring.

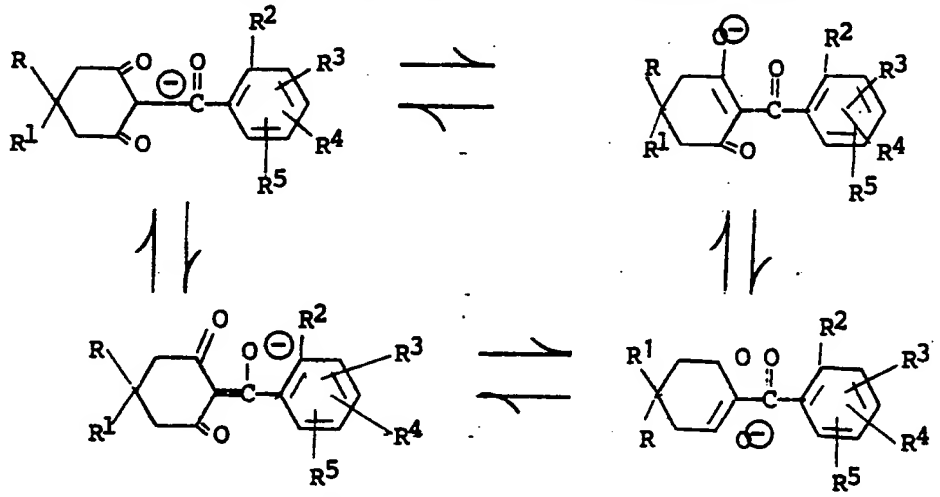
Most preferably, R^3 is chlorine, hydrogen, dimethylamino or methoxy. Preferably R^4 is hydrogen, chlorine, nitro, SO_2CH_3, $SO_2N(CH_3)_2$ or CF_3. Preferably, R^5 is hydrogen.

The compounds of this invention can have the following four structural formulae because of tautomerism:



wherein R, R^1, R^2, R^3, R^4 and R^5 are as defined above.

The circled proton on each of the four tautomers is reasonably labile. These protons are acidic and can be removed by any base to give a salt having an anion of the following four resonance forms:



wherein R, R^1, R^2, R^3, R^4 and R^5 are as defined above.

Examples of cations of these bases are inorganic cations such as alkali metals e.g. lithium, sodium, and potassium alkaline earth metals, e.g. barium, magnesium, calcium and strontium or organic cations such as

substituted ammonium, sulfonium or phosphonium wherein the substituted is an aliphatic or aromatic group.

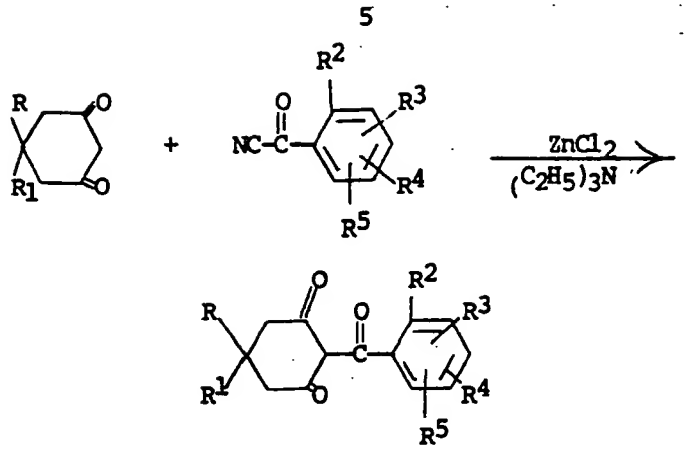
The term "aliphatic group" is used herein in a broad sense to cover a large class of organic groups characterized by being derived from (1) an acylic (open-chain structure) of the paraffin, olefin and acetylene hydrocarbon series and their derivatives or (2) alicyclic compounds. The aliphatic group can have from 1 to 10 carbon atoms.

The term "aromatic group" is used herein in a broad sense to distinguish from the aliphatic group and includes a group derived from (1) compounds having 6 to 20 carbon atoms and characterized by the presence of at least one benzene ring, including monocyclic, bicyclic and polycyclic hydrocarbons and their derivatives and (2) heterocyclic compounds having 5 to 19 carbon atoms which are similar in structure and are characterized by having an unsaturated ring structure containing at least one atom other than carbon such as nitrogen, sulfur and oxygen and derivatives of these heterocyclic compounds.

In the above description of the compounds of this invention alkyl and alkoxy include both straight and branched configurations; for example, methyl, ethyl, n-propyl, isopropyl, n-butyl, sec-butyl, isobutyl, and tert-butyl.

The compounds of this invention and their salts are active herbicides of a general type. That is, they are herbicidally effective against a wide range of plant species. The method of controlling undesirable vegetation of the present invention comprises applying an herbicidally effective amount of the above-described compounds to the area where control is desired.

The compounds of the present invention can be prepared by the following general method.



Generally, mole amounts of the dione and substituted benzoyl cyanide are used, along with a slight mole excess of zinc chloride. The two reactants and the zinc chloride are combined in a solvent such as methylene chloride. A slight mole excess of triethylamine is slowly added to the reaction mixture with cooling. The mixture is stirred at room temperature for 5 hours.

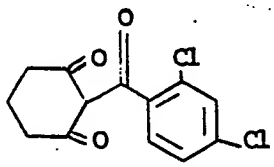
The reaction product is worked up by conventional techniques.

The above-described substituted benzoyl cyanide can be prepared according to the teaching of T.S. Oakwood and C.A. Weisgerber, Organic Synthesis Collected, Vol. III, pp. 122 (1955).

The following example teaches the synthesis of a representative compound of this invention.

EXAMPLE I

2-(2,4-Dichlorobenzoyl)-cyclohexane-1,3-dione

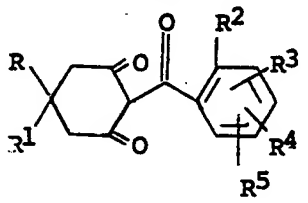


1,3-Cyclohexanedione [11.2 grams (g), 0.1 mole], 20.0 g (0.1 mole) 2,4-dichlorobenzoyl cyanide and 13.6 g (0.11 mole) anhydrous, powdered zinc chloride were combined in 100 milliliters (ml) methylene chloride. Triethylamine (10.1 g, 0.12 mole) was slowly added with cooling.

The reaction mixture was stirred at room temperature for 5 hours and then poured into 2N hydrochloric acid. The aqueous phase was discarded and the organic phase was washed with 150 ml 5% Na_2CO_3 four times. The aqueous washings were combined and acidified with HCl, extracted with methylene chloride, dried and concentrated to yield 25.3 g of crude product. The crude product was dissolved in ether and stirred with 250 ml of 5% copper (II) acetate. The resulting copper salt was filtered, washed with ether and stirred with 6N hydrochloric acid to destroy the salt. The extract was washed with ether to yield 22.15 grams of the desired product m.p. 138-140°C. (77.7% yield). The structure was confirmed by instrumental analysis.

The following is a table of certain selected compounds that are preparable according to the procedure described hereto. Compound numbers are assigned to each compound and are used throughout the remainder of the application.

TABLE I



Compound Number	R	R^1	R^2	R^3	R^4	R^5	N_D^{30} or m.p. °C
1	CH_3	CH_3	Cl	H	H	H	1.5613
2	CH_3	CH_3	Cl	H	4-Cl	H	1.5655
3	CH_3	CH_3	Cl	H	H	6-Cl	103-108
4*	H	H	Cl	H	4-Cl	H	138-140
5	CH_3	CH_3	2-Br	H	H	H	
6	CH_3	CH_3	2-Cl	H	H	5-Cl	74-77
7	H	H	Cl	H	H	5-Cl	104-107
8	H	H	Br	H	H	H	93-96
9	H	H	Cl	H	H	H	79-87
10	H	H	I	H	H	H	66-70
11	H	H	Cl	H	4-NO_2	H	118-122

TABLE I
(continued)

Compound Number	R	R^1	R^2	R^3	R^4	R^5	N_D^{30} or m.p. °C
12	H	H	Cl	H	H	6-Cl	143-148
13	H	H	Cl	H	H	5-Br	109-115
14	H	H	I	3-I	H	5-I	164-167
15	H	H	Cl	H	H	5-CH_3	60-65
16	H	H	Cl	H	4-CH_3O	H	79-86
17	H	H	Cl	H	4-CH_3	H	60-63
18	H	H	Cl	3-Cl	H	6-Cl	
19	H	H	Cl	H	H	5-CH_3O	77-80
20	H	H	Cl	3-Cl	H	H	80-90
21	H	H	Cl	H	H	5-CF_3	74-75
22	H	H	Cl	H	H	5-NO_2	140-143
23	H	H	Cl	3-Cl	4-Cl	H	152-154
24	H	H	Cl	3-Cl	4-CH_3O	H	169-170
25	H	H	Cl	H	4-Br	H	104-107
26	CH_3	CH_3	CH_3O	H	H	H	104-108
27	H	H	Cl	H	(a)	H	
28	H	H	Br	H	H	(b)	
29	H	H	CH_3O	3-CH_3O	H	H	75-79
30	H	H	CH_3O	H	H	5-CH_3O	89-92
31	H	H	Br	H	4-CH_3O	5-CH_3O	92-96
32	H	H	Br	H	(4)—OCH_2O—(5)		63-68
33	CH_3	CH_3	Cl	3-Cl	4-Cl	H	86-89
34	H	H	Cl	3-Cl	H	5-Cl	
35	CH_3	CH_3	Cl	3-Cl	H	5-Cl	105-109
36	CH_3	CH_3	Cl	3-Cl	4-Cl	5-Cl	137-139
37	H	H	Cl	3-Cl	4-Cl	5-Cl	106-110
38	H	H	Cl	H	4-Cl	5-Cl	108-111
39	$CH(CH_3)_2O-\overset{O}{\overset{\|}{C}}-$	H	Cl	H	4-Cl	H	
40	$CH_3O-\overset{O}{\overset{\|}{C}}-$	H	Cl	H	4-Cl	H	
41	$CH(CH_3)_2$	H	Cl	H	4-Cl	H	
42	$CH(CH_3)_2$	H	Cl	3-Cl	4-Cl	H	

TABLE I

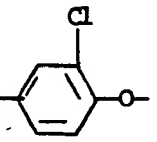
(continued)

Compound Number	R	R^1	R^2	R^3	R^4	R^5	N_D^{30} or m.p. °C
43	H	H	Cl	H	4-F	H	
44	sodium salt of Compound No. 23						85-94
45	isopropylamine salt of Compound No. 23						160-165
46	triethylamine salt of Compound No. 23						82-85
47	potassium salt of Compound No. 23						107-106
48	triethanolammonium salt of Compound No. 39						
49	sodium salt of Compound No. 43						60-63
50	$CH(CH_3)_2$	H	Cl	$3-OCH_3$	4-Br	H	
51	H	H	Cl	H	$4-CH_3SO_2-$	H	
52	H	CH_3	Cl	H	4-Cl	H	
53	$i-C_4H_7$	H	Cl	H	4-Cl	H	
54	$i-C_3H_5$	H	Cl	$3-OCH_3$	H	H	
55	CH_3	CH_3	Cl	H	$4-CH_3SO_2-$	H	
56	CH_3	CH_3	Cl	$3-CH_3$	4-Cl	H	
57	H	H	Cl	$3-CH_3$	4-Cl	H	
58	H	H	Cl	H	$4-C_2H_5SO_2-$	H	98-100
59	H	H	Cl	3-Cl	$4-C_2H_5SO_2-$	H	98-109
60	H	H	Cl	H	$4-C_3H_7SO_2-$	H	semi-solid
61	H	H	Cl	$3-OCH_3$	$4-CH_3SO_2-$	H	48-59
62	CH_3	CH_3	Cl	H	$4-n-C_3H_7SO_2-$	H	semi-solid
63	H	H	Cl	3-Cl	$4-n-C_3H_7SO_2-$	H	145-148.5
64	H	H	Cl	$3-C_2H_5S$	$4-C_2H_5SO_2-$	H	oil
65	CH_3	CH_3	Cl	H	$4-C_2H_5SO_2-$	H	103-108
66	CH_3	CH_3	Cl	3-Cl	$4-C_2H_5SO_2-$	H	108-111
67	$i-C_3H_7$	H	Cl	H	$4-C_2H_5SO_2-$	H	brown gum
68	H	H	Cl	3-Cl	$4-CH_3SO_2-$	H	145-154
69	$i-C_3H_7$	H	Cl	3-Cl	$4-CH_3SO_2-$	H	
70	H	H	Br	H	$4-CH_3SO_2$	H	brown gum
71	H	H	Cl	H	$4-i-C_3H_7SO_2-$	H	
72	H	H	Cl	H	$4-CH_3S-$	H	70-77
73	H	H	Cl	3-Cl	$4-CH_3S-$	H	
74	CH_3	CH_3	Cl	3-Cl	$4-C_2H_5SO_2-$	H	120-123

TABLE I
(continued)

Compound Number	R	R^1	R^2	R^3	R^4	R^5	N_D^{30} or m.p. °C
75	H	H	Cl	H	4-n-$C_4H_9SO_2$-	H	
76	CH_3	CH_3	Cl	H	4-n-$C_4H_9SO_2$-	H	
77	H	H	Cl	3-OC_2H_5-	4-CH_3SO_2-	H	semi-solid
78	H	H	Cl	3-OCH_3	4-n-$C_3H_7SO_2$-	H	golden gum
79	CH_3	CH_3	Cl	H	4-i-$C_3H_7SO_2$-	H	125-128

* = Prepared in example.

(a) = 4-$CH_3C(=O)$-NH- and (b) = 

Herbicidal Screening Tests

As previously mentioned, the herein described compounds produced in the above-described manner are phytotoxic compounds which are useful and valuable in controlling various plant species. Selected compounds of this invention were tested as herbicides in the following manner.

Pre-emergence herbicide test. On the day preceding treatment, seeds of eight different weed species are planted in loamy sand soil in individual rows using one species per row across the width of a flat. The seeds used are green foxtail (FT) (Setaria viridis), watergrass (WG) (Echinochloa crusgalli), wild oat (WO) (Avena fatua), annual morningglory (AMG) (Ipomoea lacunosa), velvetleaf (VL) (Abutilon theophrasti), Indian mustard (MD) (Brassica juncea), redroot pigweed (PW) (Amaranthus retroflexus) or curly dock (CD) (Rumex crispus), and yellow nutsedge (YNG) (Cyperus esculentus). Ample seeds are planted to give about 20 to 40 seedlings per row, after emergence, depending upon the size of the plants.

Using an analytical balance, 600 milligrams (mg) of the compound to be tested are weighed out on a piece of glassine weighing paper. The paper and compound are placed in a 60 milliliter (ml) wide-mouth clear bottle and dissolved in 45 ml of acetone or substituted solvent. Eighteen

ml of this solution are transferred to a 60 ml wide-mouth clear bottle and diluted with 22 ml of a water and acetone mixture (19:1) containing enough polyoxyethylene sorbitan monolaurate emulsifier to give a final solution of 0.5% (v/v). The solution is then sprayed on a seeded flat on a linear spray table calibrated to deliver 80 gallons per acre (748 L/ha). The application rate is 4 lb/acre (4.48 Kg/ha).

After treatment, the flats are placed in the greenhouse at a temperature of 70 to 80°F and watered by sprinkling. Two weeks after treatment, the degree of injury or control is determined by comparison with untreated check plants of the same age. The injury rating from 0 to 100% is recorded for each species as percent control with 0% representing no injury and 100% representing complete control.

The results of the tests are shown in the following Table II.

TABLE II

Pre-Emergence Herbicidal Activity
Application Rate — 4.48 kg/ha

Cmpd. No.	FT	WG	WO	AMG	VL	MD	PW	CD	YNG
1	100	90	20	40	65	50	35		80
2	80	90	0	30	80	90	20		90
3	0	0	0	40	40	40	0		0
4	100	100	50	35	100	100	90		95
5	100	95	65	35	90	85	50		95
6	50	25	0	25	100	100	35		80
7	80	90	10	60	100	100	100		80
8	95	95	45	40	100	80	95		95
9	95	100	55	30	100	90	100		95
10	100	100	60	20	85	100	100		95
11	85	100	30	40	100	100	100		95
12	85	85	90	75	80	95	90		90
13	85	75	10	10	85	65	95		90
14	40	10	80	0	65	40	65		100
15	40	60	20	30	100	30	75		95
16	80	80	20	55	75	90	40		95

TABLE II

(Continued)

Cmpd. No.	FT	WG	WO	AMG	VL	MD	PW	CD	YNG
17	20	-	10	25	100	95	85		90
18	65	-	30	70	100	100	85		90
19	45	60	0	30	40	0	20		60
20	30	85	20	40	95	85	40		45
21	80	100	0	80	100	100	95		95
22	20	10	0	20	75	30	45		10
23	45	95	10	0	100	85	100		95
24	-	100	0	25	70	90	-		100
25	-	100	25	80	100	100	-		100
26	40	15	0	0	0	10		0	30
27	40	80	10	20	60	50		30	75
28	65	75	0	65	100	95		75	55
29	100	95	55	10	80	75		85	95
30	20	20	20	10	40	40		50	20
31	75	95	20	20	100	95		75	10
32	90	85	20	0	100	85		75	30
33	80	70	0	40	20	40		90	80
34	60	40	0	20	95	100		100	60
35	0	10	0	0	10	20		20	10
36	0	0	0	20	100	100		100	0
37	40	0	0	20	100	60		90	-
38	10	40	0	20	90	80		20	20
39	80	10	0	0	0	0		0	90
40	60	0	0	0	0	0		0	90
41	100	100	85	40	95	100		100	100
42	60	100	25	0	0	0		0	25
43	100	100	45	40	80	90		90	100
44	90	100	0	60	100	100		100	95
45	100	100	0	60	100	100		100	100
46	20	60	0	100	100	100		100	20
47	60	70	20	100	100	100		100	60
48	60	0	0	0	0	0		0	40

TABLE II
(continued)

Cmpd. No.	FT	WG	WO	AMG	VL	MD	PW	CD	YNG
49	100	100	50	10	60	20		90	100
50	100	100	80	10	60	60		90	100
51	100	100	90	100	100	100		85	100
52	100	100	60	10	100	100		60	100
53	0	20	0	0	20	20		0	10
54	10	45	10	0	0	0		0	40
55	90	100	60	100	100	100		90	100
56	100	100	80	10	60	60		90	100
57	100	100	90	100	100	100		85	100
58	90	95	0	20	20	40		40	100
59	95	100	85	75	100	100		90	98
60	95	100	50	50	100	100		90	98
61	100	100	75	100	100	100		95	95
62	100	100	95	75	100	100		100	80
63	100	100	40	65	100	100		100	95
64	100	100	98	100	100	100		100	90
65	100	100	80	100	100	100		100	90
66	100	100	75	100	100	100		100	98
73	100	100	60	80	100	100		75	90
74	100	100	70	80	100	100		80	100
75	70	100	0	50	100	100		100	80
76	40	90	25	10	100	100		100	10
77	100	100	90	100	100	100		85	-
78	100	100	80	100	100	100		90	-

- = Species did not germinate for some reason.
A blank indicates that the weed was not tested.

Post-Emergence Herbicide Test: This test is conducted in an identical manner to the testing procedure for the pre-emergence herbicide test, except the seeds of the eight different weed species are planted 10-12 days before treatment. Also, watering of the treated flats is confined to the soil surface and not to the foliage of the sprouted plants.

The results of the post-emergence herbicide test are reported in Table III.

TABLE III

Post-Emergence Herbicidal Activity
Application Rate — 4.48 kg/ha

Cmpd. No.	FT	WG	WO	AMG	VL	MD	PW	CD	YNG
1	60	70	20	40	60	60	35		60
2	30	70	0	50	90	85	30		80
3	0	30	0	70	100	90	55		70
4	95	98	20	98	100	100	30		95
5	80	80	75	50	60	80	0		95
6	40	40	10	60	100	100	75		65
7	60	75	40	60	100	75	100		75
8	85	80	75	70	95	80	90		90
9	85	80	75	70	95	80	90		90
10	95	85	90	60	95	95	80		95
11	50	80	35	55	100	100	95		80
12	45	75	50	55	75	60	50		80
13	30	60	20	60	80	50	60		70
14	20	10	20	50	45	40	40		0
15	65	95	0	65	95	30	100		80
16	65	80	20	85	85	30	30		80
17	75	80	30	70	100	100	85		90
18	100	95	10	100	100	100	100		90
19	60	80	40	70	100	75	80		90
20	65	80	10	85	95	95	100		70
21	30	55	0	80	100	80	65		80
22	0	30	0	20	45	0	30		20
23	85	90	40	85	100	95	100		90
24	0	80	0	70	90	74	-		100
25	100	100	75	90	100	100	-		100
26	45	30	0	40	70	65		0	45
27	75	80	30	65	50	45		85	85
28	75	60	60	75	100	70		80	25
29	85	85	85	75	85	65		65	85

TABLE III

(continued)

Cmpd. No.	FT	WG	WO	AMG	VL	MD	PW	CD	YNG
30	75	50	20	10	0	0		20	40
31	60	60	20	40	40	70		100	40
32	60	25	20	40	90	65		20	40
33	10	0	0	10	10	10		100	40
34	10	10	0	5	50	30		80	0
35	0	0	0	10	60	30		40	0
36	0	0	0	20	20	20		0	0
37	0	0	0	30	40	20		80	0
38	10	10	10	20	10	20		20	10
39	40	40	20	0	0	0		5	80
40	90	70	40	20	60	80		20	65
41	60	85	85	20	40	60		100	100
42	60	50	40	70	20	40		60	60
43	100	80	30	60	100	100		80	100
44	80	85	0	60	90	90		100	80
45	90	90	10	100	100	100		100	90
46	80	100	0	60	100	100		100	100
47	100	100	0	60	100	100		100	100
48	40	40	20	10	10	10		90	40
49	40	40	40	80	100	100		60	60
50	80	60	60	50	50	60		80	70
51	80	80	95	100	100	100		100	90
52	60	60	20	20	40	40		90	60
53	10	20	20	0	0	0		0	20
54	20	40	20	5	0	0		0	40
55	40	40	40	60	60	60		80	90
56	80	60	60	50	50	60		80	70
57	80	80	80	95	100	100		100	90
58	60	70	10	70	10	10		20	80
59	100	100	90	100	-	100		100	50
60	100	100	100	100	-	100		100	70
61	90	85	90	85	-	100		100	80
62	100	85	100	75	100	100		100	35

TABLE III

(continued)

Cmpd. No.	FT	WG	WO	AMG	VL	MD	PW	CD	YNG
63	70	80	20	100	100	100		35	40
64	75	75	90	70	90	70		40	40
65	100	70	100	55	90	95		100	40
66	100	75	100	90	95	95		100	20
73	100	100	95	100	100	100		55	30
74	100	95	75	100	100	100		85	40
75	100	100	30	95	80	100		80	40
76	80	80	75	75	100	95		95	25
77	80	80	80	90	90	80		90	80
78	80	85	75	85	80	95		100	50

Pre-Emergence Multi-Weed Herbicide Test

Several compounds were evaluated at an application rate of 2 lb/acre (2.24 kg/ha) for pre-emergence activity against a larger number of weed speices.

The process was generally similar to the pre-emergence herbicide test described above except that only 300 milligrams of test compound were weighed out and the application rate was 40 gallons per acre.

Redroot pigweed (PW) and curly dock (CD) were eliminated in this test and the following weed species were added:

Grasses:	downybrome	Bromus tectorum	(DB)
	annual ryegrass	Lolium multiflorum	(ARG)
	rox-orange sorghum	Sorghum bicolor	(SHC)
	hemp sesbania	Sesbania exaltata	(SESB)
	nightsaade	Solanum sp.	(SP)
	cocklebur	Xattiium sp.	(CB)

The results of the test are shown in Table IV.

TABLE IV

Pre-Emergence Multi-weed Herbicide Test

Cmpd. No.	DB	FT	ARG	WG	SHC	WO	BSG	AMG	SESB	VL	SP	MD	YNS	CB
67	20	90	25	98	80	60	90	45	90	45	20	85	85	15
68	65	98	98	100	100	60	95	100	100	100	80	100	95	100
69	65	100	70	100	100	65	95	100	95	70	65	100	90	-
70	98	100	100	100	100	90	98	90	100	90	60	100	95	80
71	60	20	100	100	100	80	95	35	40	100	20	90	100	40
72	100	100	100	100	100	100	100	100	90	100	60	100	100	20

The compounds of the present invention are useful as herbicides, especially as pre-emergence herbicides, and can be applied in a variety of ways at various concentrations. In practice, the compounds herein defined are formulated into herbicidal compositions, by admixture, in herbicidally effective amounts, with the adjuvants and carriers normally employed for facilitating the dispersion of active ingredients for agricultural applications, recognizing the fact that the formulation and mode of application of a toxicant may affect the activity of the materials in a given application. Thus, these active herbicidal compounds may be formulated as granules of relatively large particle size, as wettable powders, as emulsifiable concentrates, as powdery dusts, as solutions or as any of several other known types of formulations, depending upon the desired mode of application. Preferred formulations for pre-emergence herbicidal applications are wettable powders, emulsifiable concentrates and granules. These formulations may contain as little as about 0.5% to as much as about 95% or more by weight of active ingredient. A herbicidally effective amount depends upon the nature of the seeds or plants to be controlled and the rate of application varies from about 0.05 to approximately 25 pounds per acre, preferably from about 0.1 to about 10 pounds per acre.

Wettable powders are in the form of finely divided particles which disperse readily in water or other dispersants. The wettable powder is ultimately applied to the soil either as a dry dust or as a dispersion in water or other liquid. Typical carriers for wettable powders include

fuller's earth, kaolin clays, silicas and other readily wet organic or inorganic diluents. Wettable powders normally are prepared to contain about 5% to about 95% of the active ingredient and usually also contain a small amount of wetting, dispersing, or emulsifying agent to facilitate wetting and dispersion.

Emulsifiable concentrates are homogeneous liquid compositions which are dispersible in water or other dispersant, and may consist entirely of the active compound with a liquid or solid emulsifying agent, or may also contain a liquid carrier, such as xylene, heavy aromatic naphthal, isophorone and other non-volatile organic solvents. For herbicidal application, these concentrates are dispersed in water or other liquid carrier and normally applied as a spray to the area to be treated. The percentage by weight of the essential active ingredient may vary according to the manner in which the composition is to be applied, but in general comprises about 0.5% to 95% of active ingredient by weight of the herbicidal composition.

Granular formulations wherein the toxicant is carried on relatively coarse particles, are usually applied without dilution to the area in which suppression of vegetation is desired. Typical carriers for granular formulations include sand, fuller's earth, bentonite clays, vermiculite, perlite and other organic or inorganic materials which absorb or which may be coated with the toxicant. Granular formulations normally are prepared to contain about 5% to about 25% of active ingredients which may include surface-active agents such heavy aromatic naphthas, kerosene or other petroleum fractions, or vegetable oils; and/or stickers such as destrins, glue or synthetic resins.

Typical wetting, dispersing or emulsifying agents used in agricultural formulations include, for example, the alkyl and alkylaryl sulfonates and sulfates and their sodium salts; polyhydric alcohols; and other types of surface-active agents, many of which are available in commerce. The surface-active agent, when used, normally comprises from 0.1% to 15% by weight of the herbicidal composition.

Dusts, which are free-flowing admixtures of the active ingredient with finely divided solids such as talc, clays, flours and other organic and inorganic solids which act as dispersants and carriers for the toxicant, are useful formulations for soil-incorporating application.

Pastes, which are homogeneous suspensions of a finely divided solid toxicant in a liquid carrier such as water or oil, are employed for specific purposes. These formulations normally contain about 5% to about 95% of active ingredient by weight, and may also contain small amounts of a wetting, dispersing or emulsifying agent to facilitate dispersion. For application, the pastes are normally diluted and applied as a spray to the area to be affected.

Other useful formulations for herbicidal applications include simple solutions of the active ingredient in a dispersant in which it is completely soluble at the desired concentration, such as acetone, alkylated naphthalenes, xylene and other organic solvents. Pressurized sprays, typically aerosols, wherein the active ingredient is dispersed in finely-divided form as a result of vaporization of a low boiling dispersant solvent carrier, such as the Freons, may also be used.

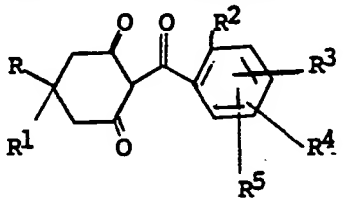
The phytotoxic compositions of this invention are applied to the plants in the conventional manner. Thus, the dust and liquid compositions can be applied to the plant by the use of power-dusters, boom and hand sprayers and spray dusters. The compositions can also be applied from airplanes as a dust or a spray because they are effective in very low dosages. In order to modify or control growth of germinating seeds or emerging seedlings, as a typical example, the dust and liquid compositions are applied to the soil according to conventional methods and are distributed in the soil to a depth of at least 1/2 inch below the soil surface. It is not necessary that the phytotoxic compositions be admixed with the soil particles since these compositions can also be applied merely by spraying or sprinkling the surface of the soil. The phytotoxic compositions of this invention can also be applied by addition to irrigation water supplied to the field to be treated. This method of application permits the penetration of the compositions into the soil as the water is absorbed therein. Dust compositions, granular compositions or liquid

formulations applied to the surface of the soil can be distributed below the surface of the soil by conventional means such as discing, dragging or mixing operations.

The phytotoxic compositions of this invention can also contain other additaments, for example, fertilizers and other herbicides, pesticides and the like, used as adjuvant or in combination with any of the above-described adjuvants. Other phytotoxic compounds useful in combination with the above-described compounds include, for example, anilides such as 2-benzothiazole-2-yloxy-N-methyl acetanilide, 2-chloro-2',6'-dimethyl-N-(n-propylethyl) acetanilide, 2-chloro-2',6'-diethyl-N-(butoxymethyl) acetanilide; 2,4-dichlorophenoxyacetic acids, 2,4,5-trichlorophenoxyacetic acid, 2-methyl-4-chlorophenoxyacetic acid and the salts, esters and amides thereof; triazine derivatives, such as 2,4-bis(3-methoxypropylamino)-6-methylthio-s-triazine, 2-chloro-4-ethylamino-6-isopropylamino-s-triazine, and 2-ethylamino-4-isopropyl-amino-6-methyl-mercapto-s-triazine; urea derivatives, such as 3-(3,5-dichlorophenyl)-1,1-dimethylurea and 3-(p-chlorophenyl)-1,1-dimethylurea; and acetamides such as N,N-diallyl-α-chloroacetamide, and the like; benzoic acids such as 3-amino-2,5-dichlorobenzoic acid; thiocarbamates such as S-(1,1-dimethylbenzyl)-piperidene-1-carbothiaote, 3-(4-chlorophenyl)-methyl diethylcarbothioate, ethyl-1-hexahydro-1,4-azepine-1-carbothioate, S-ethyl-hexahydro-1H-azepine-1-carbothioate, S-propyl N,N-dipropylthiocarbamate, S-ethyl N,N-dipropylthiocarbamate, S-ethyl cyclohexylethylthiocarbamate, S-ethyl hexahydro-1H-azepine-1-carbothioate and the like; anilines such as 4-(methylsulfonyl)-2,6-dinitro-N,N-substituted aniline, 4-trifluoromethyl-2,6-dinitro-N,N-di-n-propyl aniline, 4-trifluoromethyl-2,6-dinitro-N-ethyl-N-butyl aniline, 2-[4-(2,4-dichlorophenoxy)phenoxy]propanoic acid, 2-[1-(ethoxyimino)-butyl]-5-[2-ethylthio)propyl]-3-hydroxy-2-cyclohexene-1-one, (±)-butyl-2-[4-[(5-trifluoromethyl)-2-pyridinyl)oxy]phenoxy]propanate, sodium 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate, 3-isopropyl-1H-2,1,3-benzothiadiazine-4(3H)-one-2,2-dioxide, and 4-amino-6-tert-butyl-3-(methylthio)-s-triazin-5(4H)-one or (4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one) and S-(O,O-diisopropyl)-benzene sulfonamide. Fertilizers useful in combination with the active ingredients include, for example, ammonium nitrate, urea and superphosphate. Other useful additaments include materials in which plant organisms take root and grow such as compost, manure, humus, sand, and the like.

WE CLAIM:

1. A compound having the structural formula

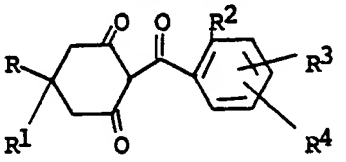


wherein

R and R^1 are hydrogen, C_1-C_4 alkyl, $R^aOC(O)$-, where R^a is C_1-C_4 alkyl;

R^2 is chlorine, bromine, iodine or C_1-C_4 alkoxy; and

R^3, R^4 and R^5 independently are hydrogen or an aliphatic group, and their salts with the proviso that compounds having the structural formula



wherein

R and R^1 are hydrogen or C_1-C_4 alkyl;

R^2 is chlorine, bromine, or iodine;

R^3 is hydrogen, iodine or chlorine; and

R^4 is hydrogen, halogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, nitro, or trifluoromethyl are excluded.

2. The compounds of Claim 1 wherein R and R^1 are hydrogen or C_1-C_4 alkyl; R^2 is chlorine, bromine, iodine or C_1-C_4 alkoxy; R^3, R^4 and R^5 independently are hydrogen, halogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, OCF_3, cyano, nitro, C_1-C_4 haloalkyl, R^bSO_n wherein R^b is C_1-C_4 alkyl; C_1-C_4 haloalkyl, phenyl, benzyl, $-NR^dR^e$ wherein R^d and R^e independently are hydrogen and C_1-C_4 alkyl; and n is the integer 0, 1 or 2; $R^cC(O)NH$- wherein R^c is C_1-C_4 alkyl; $R^fC(O)$- wherein R^f is hydrogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy; or $-NR^gR^h$ wherein R^g and R^h independently are hydrogen or C_1-C_4 alkyl and their salts.

3. The compounds of Claim 1 wherein R and R^1 are hydrogen or methyl; R^2 is chlorine or methoxy; R^3 is hydrogen, chlorine, dimethylamino or

methoxy; R^4 is hydrogen, chlorine, nitro, SO_2CH_3, $SO_2N(CH_3)_2$ or CF_3; and R^5 is hydrogen and their salts.

4. The compounds of Claim 3 wherein R^3 is substituted at the 3-position, R^4 is substituted at the 4-position and R^5 is substituted at the 5- or 6-position and their salts.

5. The compounds of Claim 3 wherein R and R^1 are hydrogen; R^2 is chlorine or methoxy; R^3 is hydrogen, 3-chlorine, 4-methoxy or 3-dimethylamino and R^4 is 4-chlorine, 4-CH_3SO_2- or 4-CF_3SO_2; and R^5 is hydrogen and their salts.

6. The compounds of Claim 2 wherein R^2 is chlorine and their salts.

7. The compound of Claim 1 wherein R is methyl, R^1 is methyl, R^2 is chlorine, R^3 is hydrogen, R^4 is hydrogen, and R^5 is 6-chlorine and its salts.

8. The compound of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is is chlorine, R^3 is hydrogen, R^4 is hydrogen, R^5 is 6-chlorine and its salts.

9. The compound of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

10. The compound of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine and R^4 is hydrogen and R^5 is 6-chlorine and its salts.

11. The compound of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is hydrogen and R^5 is 5-trifluoromethyl and its salts.

12. The compound of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

13. The compound of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine, R^4 is 4-methoxy and R^5 is hydrogen and its salts.

14. The compound of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-bromine and R^5 is hydrogen and its salts.

15. The compound of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is methoxy, R^3 is 3-methoxy, R^4 is hydrogen and R^5 is hydrogen and its salts.

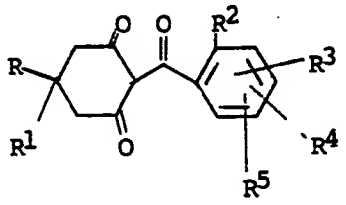
16. The compound of Claim 1 wherein R is isopropyl, R^1 is hydrogen, R^2 is chlorine, R^3 is hydorgen, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

17. The compound of Claim 1 wherein R is isopropyl, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-CH_3, R^4 is 4-CH_3SO_2 and R^5 is hydrogen and its salts.

18. The compound of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-CH_3SO_2 and R^5 is hydrogen and its salts.

19. The sodium, isopropylamine, triethylamine and potassium salts of the compound of Claim 12.

20. The method of controlling undesirable vegetation comprising applying to the area where control is desired, an herbicidally effective amount of a compound having the formula

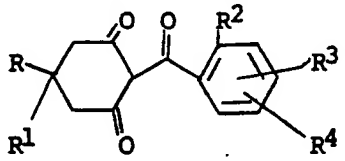


wherein

R and R^1 are hydrogen, C_1-C_4 alkyl, $R^aOC(O)$-, where R^a is C_1-C_4 alkyl;

R^2 is chlorine, bromine, iodine or C_1-C_4 alkoxy; and

R^3, R^4 and R^5 independently are hydrogen or an aliphatic group with the proviso that compounds having the structural formula



wherein

R and R^1 are hydrogen or C_1-C_4 alkyl;

R^2 is chlorine, bromine, or iodine;

R^3 is hydrogen, iodine or chlorine; and

R^4 is hydrogen, halogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, nitro, or trifluoromethyl are excluded.

21. The method of Claim 20 wherein R and R^1 are hydrogen or C_1-C_4 alkyl; R^2 is chlorine, bromine, iodine or C_1-C_4 alkoxy; R^3, R^4 and R^5 independently are hydrogen, halogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, OCF_3; cyano, nitro, C_1-C_4 haloalkyl, R^bSO_n wherein R^b is C_1-C_4 alkyl; C_1-C_4 haloalkyl, phenyl, benzyl, $-NR^dR^e$ wherein R^d and R^e independently are hydrogen and C_1-C_4 alkyl; and n is the integer 0, 1 or 2; $R^cC(O)NH$- wherein R^c is C_1-C_4 alkyl; $R^fC(O)$- wherein R^f is hydrogen, C_1-C_4 alkyl, C_2-C_4 haloalkyl, C_1-C_4 alkoxy; or $-NR^gR^h$ wherein R^g and R^h independently are hydrogen or C_1-C_4 alkyl and their salts.

22. The method of Claim 20 wherein R and R^1 are hydrogen or methyl; R^2 is chlorine or methoxy; R^3 is hydrogen, chlorine or methoxy; R^4 is hydrogen, chlorine, nitro, SO_2CH_3, $SO_2N(CH_3)_2$ or CF_3; and R^5 is hydrogen and their salts.

23. The method of Claim 22 wherein R^3 is substituted at the 3-position, R^4 is substituted at the 4-position and R^5 is substituted at the 5- or 6-position and their salts.

24. The method of Claim 22 wherein R and R^1 are hydrogen; R^2 is chlorine or methoxy; R^3 is hydrogen, 3-chlorine, 3-methoxy or

3-dimethylamino; R^4 is 4-chlorine, 4-CH_2SO_2, or 4-CF_3SO_2; and R^5 is hydrogen and their salts.

25. The method of Claim 24 wherein R^2 is chlorine and their salts.

26. The method of Claim 20 wherein R is methyl, R^1 is methyl, R^2 is chlorine, R^3 is hydrogen, R^4 is hydrogen, and R^5 is 6-chlorine and its salts.

27. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is is chlorine, R^3 is hydrogen, R^4 is hydrogen, R^5 is 6-chlorine and its salts.

28. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

29. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine and R^4 is hydrogen and R^5 is 6-chlorine and its salts.

30. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is hydrogen and R^5 is 5-trifluoromethyl and its salts.

31. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

32. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine, R^4 is 4-methoxy and R^5 is hydrogen and its salts.

33. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-bromine and R^5 is hydrogen and its salts.

34. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is methoxy, R^3 is 3-methoxy, R^4 is hydrogen and R^5 is hydrogen and its salts.

35. The method of Claim 20 wherein R is isopropyl, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

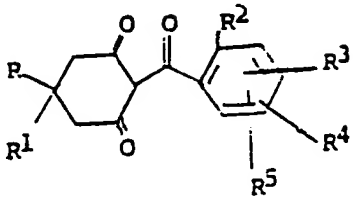
36. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-CH_3O, R^4 is 4-CH_3SO_2 chlorine and R^5 is hydrogen and its salts.

37. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-CH_3SO_2 and R^5 is hydrogen and its salts.

38. The sodium, isopropylamine, triethylamine and potassium salts of the method of Claim 31.

Claims for Austria

1. Process for preparing compounds having the structural formula



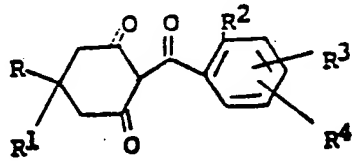
wherein

R and R^1 are hydrogen, C_1-C_4 alkyl, $R^aOC(O)$-, where R^a is C_1-C_4 alkyl;

R^2 is chlorine, bromine, iodine or C_1-C_4 alkoxy; and

R^3, R^4 and R^5 independently are hydrogen or an aliphatic group,

and their salts with the proviso that compounds having the structural formula



wherein

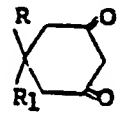
R and R^1 are hydrogen or C_1-C_4 alkyl;

R^2 is chlorine, bromine, or iodine;

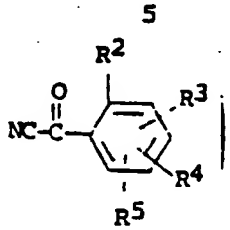
R^3 is hydrogen, iodine or chlorine; and

R^4 is hydrogen, halogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, nitro, or trifluoromethyl are excluded.

comprising reacting a substituted dione of the general formula II



with a substituted benzoyl cyanide of the general formula III



and working up the reaction product by conventional techniques.

2. The process of Claim 1 wherein R and R^1 are hydrogen or C_1-C_4 alkyl; R^2 is chlorine, bromine, iodine or C_1-C_4 alkoxy; R^3, R^4 and R^5 independently are hydrogen, halogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, OCF_3, cyano, nitro, C_1-C_4 haloalkyl, R^bSO_n wherein R^b is C_1-C_4 alkyl; C_1-C_4 haloalkyl, phenyl, benzyl, $-NR^dR^e$ wherein R^d and R^e independently are hydrogen and C_1-C_4 alkyl; and n is the integer 0, 1 or 2; $R^cC(O)NH-$ wherein R^c is C_1-C_4 alkyl; $R^fC(O)-$ wherein R^f is hydrogen, C_1-C_4 alkyl, C_1-C_4 haloalkyl, C_1-C_4 alkoxy; or $-NR^gR^h$ wherein R^g and R^h independently are hydrogen or C_1-C_4 alkyl and their salts.

3. The process of Claim 1 wherein R and R^1 are hydrogen or methyl; R^2 is chlorine or methoxy; R^3 is hydrogen, chlorine, dimethylamino or methoxy; R^4 is hydrogen, chlorine, nitro, SO_2CH_3, $SO_2N(CH_3)_2$ or CF_3; and R^5 is hydrogen and their salts.

4. The process of Claim 3 wherein R^3 is substituted at the 3-position, R^4 is substituted at the 4-position and R^5 is substituted at the 5- or 6-position and their salts.

5. The process of Claim 3 wherein R and R^1 are hydrogen; R^2 is chlorine or methoxy; R^3 is hydrogen, 3-chlorine, 4-methoxy or 3-dimethylamino and R^4 is 4-chlorine, 4-CH_3SO_2- or 4-CF_3SO_2; and R^5 is hydrogen and their salts.

6. The process of Claim 2 wherein R^2 is chlorine and their salts.

7. The process of Claim 1 wherein R is methyl, R^1 is methyl, R^2 is chlorine, R^3 is hydrogen, R^4 is hydrogen, and R^5 is 6-chlorine and its salts.

8. The process of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is is chlorine, R^3 is hydrogen, R^4 is hydrogen, R^5 is 6-chlorine and its salts.

9. The process of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

10. The process of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine and R^4 is hydrogen and R^5 is 6-chlorine and its salts.

11. The process of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is hydrogen and R^5 is 5-trifluoromethyl and its salts.

12. The process of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

13. The process of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine, R^4 is 4-methoxy and R^5 is hydrogen and its salts.

14. The process of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-bromine and R^5 is hydrogen and its salts.

15. The process of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is methoxy, R^3 is 3-methoxy, R^4 is hydrogen and R^5 is hydrogen and its salts.

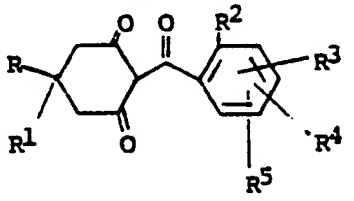
16. The process of Claim 1 wherein R is isopropyl, R^1 is hydrogen, R^2 is chlorine, R^3 is hydorgen, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

17. The process of Claim 1 wherein R is isopropyl, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-CH_3, R^4 is 4-CH_3SO_2 and R^5 is hydrogen and its salts.

18. The process of Claim 1 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-CH_3SO_2 and R^5 is hydrogen and its salts.

19. The process of claim 12 comprising preparing the sodium, isopropylamine, triethylamine and potassium salts of the compound of Claim 12.

20. The method of controlling undesirable vegetation comprising applying to the area where control is desired, an herbicidally effective amount of a compound having the formula

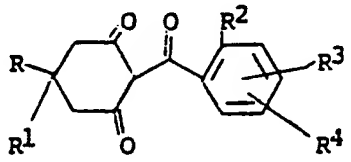


wherein

R and R^1 are hydrogen, C_1-C_4 alkyl, $R^aOC(O)$-, where R^a is C_1-C_4 alkyl;

R^2 is chlorine, bromine, iodine or C_1-C_4 alkoxy; and

R^3, R^4 and R^5 independently are hydrogen or an aliphatic group with the proviso that compounds having the structural formula



wherein

R and R^1 are hydrogen or C_1-C_4 alkyl;

R^2 is chlorine, bromine, or iodine;

R^3 is hydrogen, iodine or chlorine; and

R^4 is hydrogen, halogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, nitro, or trifluoromethyl are excluded.

21. The method of Claim 20 wherein R and R^1 are hydrogen or C_1-C_4 alkyl; R^2 is chlorine, bromine, iodine or C_1-C_4 alkoxy; R^3, R^4 and R^5 independently are hydrogen, halogen, C_1-C_4 alkyl, C_1-C_4 alkoxy, OCF_3; cyano, nitro, C_1-C_4 haloalkyl, R^bSO_n wherein R^b is C_1-C_4 alkyl; C_1-C_4 haloalkyl, phenyl, benzyl, $-NR^dR^e$ wherein R^d and R^e independently are hydrogen and C_1-C_4 alkyl; and n is the integer 0, 1 or 2; $R^cC(O)NH$- wherein R^c is C_1-C_4 alkyl; $R^fC(O)$- wherein R^f is hydrogen, C_1-C_4 alkyl, C_2-C_4 haloalkyl, C_1-C_4 alkoxy; or $-NR^gR^h$ wherein R^g and R^h independently are hydrogen or C_1-C_4 alkyl and their salts.

22. The method of Claim 20 wherein R and R^1 are hydrogen or methyl; R^2 is chlorine or methoxy; R^3 is hydrogen, chlorine or methoxy; R^4 is hydrogen, chlorine, nitro, SO_2CH_3, $SO_2N(CH_3)_2$ or CF_3; and R^5 is hydrogen and their salts.

23. The method of Claim 22 wherein R^3 is substituted at the 3-position, R^4 is substituted at the 4-position and R^5 is substituted at the 5- or 6-position and their salts.

24. The method of Claim 22 wherein R and R^1 are hydrogen; R^2 is chlorine or methoxy; R^3 is hydrogen, 3-chlorine, 3-methoxy or

3-dimethylamino; R^4 is 4-chlorine, 4-CH_2SO_2, or 4-CF_3SO_2; and R^5 is hydrogen and their salts.

25. The method of Claim 24 wherein R^2 is chlorine and their salts.

26. The method of Claim 20 wherein R is methyl, R^1 is methyl, R^2 is chlorine, R^3 is hydrogen, R^4 is hydrogen, and R^5 is 6-chlorine and its salts.

27. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is is chlorine, R^3 is hydrogen, R^4 is hydrogen, R^5 is 6-chlorine and its salts.

28. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

29. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine and R^4 is hydrogen and R^5 is 6-chlorine and its salts.

30. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is hydrogen and R^5 is 5-trifluoromethyl and its salts.

31. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

32. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-chlorine, R^4 is 4-methoxy and R^5 is hydrogen and its salts.

33. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-bromine and R^5 is hydrogen and its salts.

34. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is methoxy, R^3 is 3-methoxy, R^4 is hydrogen and R^5 is hydrogen and its salts.

35. The method of Claim 20 wherein R is isopropyl, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-chlorine and R^5 is hydrogen and its salts.

36. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is 3-CH_3O, R^4 is 4-CH_3SO_2 chlorine and R^5 is hydrogen and its salts.

37. The method of Claim 20 wherein R is hydrogen, R^1 is hydrogen, R^2 is chlorine, R^3 is hydrogen, R^4 is 4-CH_3SO_2 and R^5 is hydrogen and its salts.

38. The sodium, isopropylamine, triethylamine and potassium salts of the method of Claim 31.

European Patent Office

EUROPEAN SEARCH REPORT

Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 84109807.2

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	EP - A1 - 0 017 195 (EISAI CO., LTD.) * Claims 1,9 * --	1	C 07 C 49/813 C 07 C 49/84 C 07 C 62/38 C 07 C 79/36 C 07 C 147/06 C 07 C 149/273 C 07 D 317/62 A 01 N 35/06
P,X	EP - A2 - 0 090 262 (STAUFFER CHEMICAL COMPANY) * Claims 1-12 * --	1-4,6-14,16,20-33,35	
A	US - A - 4 283 348 (THOMAS N. WHEELER) * Abstract * --	1,20	
A	US - A - 4 227 919 (REED A GRAY et al.) * Abstract * --	1,20	
A	US - A - 4 256 658 (THOMAS N. WHEELER) * Abstract * ----	1,20	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

C 07 C 49/00
C 07 C 62/00
C 07 C 79/00
C 07 C 147/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	27-11-1984	REIF

CATEGORY OF CITED DOCUMENTS

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